



## NASA STTR 2016 Phase I Solicitation

### T6.03 Sustainability in Space

Lead Center: JSC

Survival in remote locations such as another planet requires conservation, smart utilization and reuse of resources and resilience, especially in the event of a failed resupply ship. Closed loop living systems such as this are also important for Earth as world population grows and natural resources decrease. This STTR subtopic seeks to advance the state-of-the-art for spacecraft habitats by “closing the loop” on materials needed to sustain life and provide energy on exploration missions, while simultaneously reducing the environmental impact of aerospace processes. Air, water and waste all need to be regenerated with highly reliable systems to reduce or eliminate the need to launch more materials into space as missions become longer. Energy for life support and other systems can also be obtained from renewable energy sources or waste streams. Many current cleaning, manufacturing and testing processes for spacecraft also create an environmental burden that could be mitigated by new technologies. All these “green” technologies will improve sustainability in space and on Earth.

Technical innovation and unique approaches are solicited for the development of new technologies that will lower mission cost and environmental impact by conserving resources and closing the materials loop. This will enable self-sufficiency and thus longer space exploration missions. Also, technologies that conserve resources or reduce negative impact during spacecraft development are solicited to improve sustainability at NASA. Real world demonstration of the technologies should be emphasized, even in Phase I. Many areas of research are possible, but preference will be given to those that address gaps in the following areas and lead to early applications and dual use partnerships:

- *Waste Water Treatment and Reuse* - Reuse/recycling of waste water from gray and black water sources with minimal mass, power, volume and expendables is needed. A particular challenge is treatment of urine to prevent odor and fouling of systems without the use of hazardous chemicals. NASA would like to extract nearly 100% of the water from any brine that may be created by a primary processor. Easy regeneration of filter and resin elements is desirable to reduce expendables.
- *Waste Processing* – Technologies for stabilization, safening, recycling or creation of energy or useful products from feces or trash are sought. Proposed technologies must take into account relevant factors for space exploration such as resource scarcity, planetary protection and human factors.
- *Renewable Energy and use of Waste Heat* – Solar and other renewable energy technologies that apply to “closing the loop” in space and on Earth are sought. This could include high efficiency and regenerative fuel cell technologies and technologies that combine waste and water treatment with energy production. Also included are technologies that make use of waste heat from one process for another purpose.
- *Greener Ground Processing* – Many aerospace processes require chemicals that are not environmentally friendly or result in lots of waste. NASA seeks technologies that will significantly reduce environmental impacts for NASA as well as others who use similar processes. Technologies are sought that: reduce or eliminate solvent waste from precision cleaning and validation processes; improve particle removal efficiency when cleaning with supercritical fluids; combine multi step processes (such as metal cleaning and passivation) into one step with reduction of waste.

